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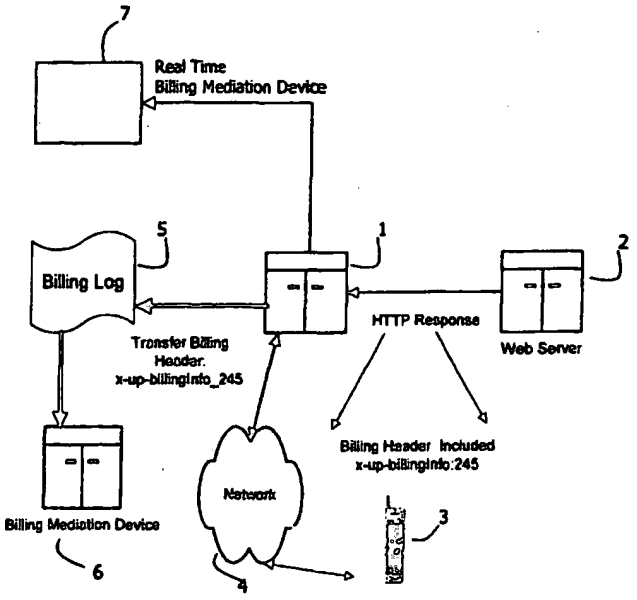
(54) Title: A NETWORK-BASED BILLING METHOD AND SYSTEM



(57) Abstract: A gateway (1) routes signals between a WAP mobile phone (3) and an application on a Web server (2). The application generates a message for each of a number of events recognised according to the service being provided. These messages are transmitted to the gateway (1). A billing manager in the gateway (1) directs the messages in real time to a real time mediation device (7) if they relate to a pre-pay service, or alternatively to a billing log (5) for off-line processing. The network operator operating the gateway can thus charge in a manner relating to services provided instead of simply call duration.

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"A network-based billing method and system"

INTRODUCTION

Field of the Invention

The invention relates to billing in a network environment in which server applications communicate with clients via a gateway. The term "gateway" is intended to mean any access or routing device between server applications and clients. It may, for example be a WAP gateway, in which case the clients are mobile handsets.

Prior Art Discussion

At present, there are quite extensive mechanisms for processing subscriber billing data in telecommunication networks such as mobile networks. However, such processing has been inflexible and so only generate billing data according to limited parameters such as time duration of a call. Such an arrangement is described in United States Patent Serial No. US5873030 (MCI), in which local mobile networks connect with a national mobile service platform (MNSP) to provide traffic-related billing data.

Objects of the Invention

It is therefore an object of the invention to provide for more flexible billing data processing in a network environment.

SUMMARY OF THE INVENTION

According to the invention, there is provided a method of capturing billing data for operation of an application on a network server communicating with a client via a gateway, the method comprising the steps of:-

the application automatically generating billing data relating to a service it provides;

the application automatically transmitting the billing data to the gateway; and

the gateway processing the billing data.

In one embodiment, the application transmits the billing data in an event message according to a pre-set format.

In another embodiment, the message comprises a HTTP header.

In one embodiment, the application generates a message for each activity recognised as an event and transmits said messages to the gateway.

In another embodiment, the application recognises a plurality of events for a transaction.

In a further embodiment, the application includes a common event linkage identifier in each event message associated with a particular transaction.

In one embodiment, the application recognises a transaction failure as an event.

In another embodiment, the application recognises a time-out as an event.

Preferably, each event message has a unique identifier.

In one embodiment, the identifier is a number whereby identifiers of sequential messages are sequential numbers.

In another embodiment, each event message comprises at least one parameter value.

In one embodiment, each parameter value is represented in a tag-length-value format in which a tag field identifies a parameter name, the length field identifies the length of the value in bytes, and the value field contains the parameter value.

In another embodiment, the gateway generates billing data according to signal flows between the application and the client, and stores said billing data in addition to that originating from the application.

In a further embodiment, the gateway recognises events according to signal flows between the application and the client, and generates corresponding messages.

In one embodiment, the gateway routes event messages to a billing log for off-line processing or to a real time mediation device for real time processing according to configuration settings.

In another embodiment, the gateway routes event messages to the real time mediation device if the events relate to pre-paid services.

In a further embodiment, within the gateway, messages are routed in real time to a billing manager, and said billing manager processes the messages.

According to another aspect, the invention provides a gateway for routing of signals between a client and an application hosted on a network server for performance of a transaction, the gateway comprising:

means for receiving billing data from the application, said billing data relating to a service provided by the application; and

means for processing the billing data.

In one embodiment, the processing means comprises means for classifying the data as requiring real time processing or off-line processing, and for routing the data accordingly.

In another embodiment, the billing data is incorporated in event messages.

In a further embodiment, the gateway comprises means for generating event messages according to handling of signals for transaction.

In one embodiment, the gateway comprises a billing manager, means for routing billing data in real time to the billing manager, and means in the billing manager for directing storage of the data in a log for off-line processing or for routing the data to a real time mediation device for real time processing.

According to a still further aspect, the invention provides a billing system comprising:

a gateway as described above;

a mediation device comprising means for reading billing data in a billing log which is updated by the gateway and for processing said billing data; and

a real time mediation device comprising means for performing real time processing of billing data received from the gateway.

DETAILED DESCRIPTION OF THE INVENTION

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawing which is a schematic representation of a billing data processing method and system.

Referring to Fig. 1, there is shown a WAP gateway 1 communicating with a Web (or "origin") server 2 hosting Web-based applications such as on-line shopping applications. The gateway 1 communicates with mobile handset clients 3 via a mobile network 4. The gateway 1 maintains a billing log 5, and the log 5 is accessed by a billing mediation device 6. The gateway 1 also communicates with a real time billing mediation device 7. The gateway 1 comprises an internal software function called a Billing Manager.

An application on the server 2 carries out its operations in conventional manner for processing transactions. However, the application is also programmed to generate messages including a billing-related HTTP header. The header is in a pre-set format, which may be published and used by many Web-based applications on many Web servers. In this embodiment the header has the format "x-up-billing-info:_____". A simple example is "x-up-billing-info:245" to indicate to the gateway 1 that a user (of the client handset 3) has made on-line shopping purchases worth $245 while accessing that application.

The application generates the messages in response to events associated with the service being provided. These events will not all be "billable" and so some messages do not include billing headers.

The gateway 1 detects and extracts each such header. In this embodiment, this is performed by code in the gateway stack recognising the header. The header is forwarded in real time to the (internal) Billing Manger.

Where the billing data is not required to be processed in real time, the Billing Manager sends the contents of the billing header (together with any others received in the preceding period) to the billing log 5. In this embodiment, the billing log 5 resides on the gateway 1, however, it may reside on an external entity. Subsequently, the billing mediation device 6 (which is operated by the mobile network operator) accesses the billing log and uses the data for billing purposes. For example, the mobile network operator may use the data to charge the user or the operator of the application a handling fee of say, 1% of the transaction value. Thus, the invention allows parties who are not hosting the application to make charges for service events on an agreed basis with the application host organisation and the user.

In the embodiment described above, the header value is a single numeric value, however, it may be a combination of both text and numerical information and the content of the header may be set according to the particular application.

The Billing Manager may route the billing data to the mediation device 7 in real time. Also, the gateway 1 may transmit the billing data to the client.

In more detail, an event reflects some aspect of the processing of a transaction, and a transaction is a complete request/response cycle from the user's perspective. Each message generated in response to an event contains a number of fields, which hold common information such as source, destination addresses, and data specific to the event itself such as the URI being retrieved or the volume of data downloaded.

Multiple messages may be created for a single transaction. Each message has a numeric identifier, and all messages that relate to the same transaction are linked

with a unique number, called the *event linkage id* (ELID). The ELID is used to ensure that all messages related to one transaction can be associated, for example during processing by a billing mediation device 6 or 7. The gateway manages the generation and allocation of ELIDs.

The internal components of the gateway (for example processes) also recognise events to mark the progress of a transaction at discrete points, for example, when a response is received from the Web server or when the content has been confirmed to have been received by the client etc. As each event is recognised an associated message is communicated in real-time to the Billing Manager.

The Billing Manager may write the message (or some of its data) to the billing log 5 and/or can send it directly (in real-time) to a real-time billing mediation device 7. The choice of whether to write the message to the billing log or send it via the real-time interface is configurable within the gateway 1. For example, real-time output might be used for prepaid subscribers to allow their available credit to be updated as they perform transactions, while the billing log 5 might be used for post-paid subscribers who are billed periodically. The exhaustion of a pre-pay user's credit would be detected by the real-time billing mediation device, and the configuration of the gateway components would automatically be updated to deny service to that particular subscriber. Subsequently, when the user's credit is re-established the configuration of the gateway would be altered to permit subscriber requests.

Each message is formatted as a Tag-Length-Value (TLV) as described in more detail below. Messages are written to the billing log file in their TLV format. For the real-time interface, a TCP socket connection is established between the Billing Manager and the real-time billing mediation device 7. The Billing Manager outputs the appropriate messages directly onto this connection.

A transaction is generally regarded as a single request and response between the client and the Web server. The transaction may have been initiated either by the client (pull) or by the web server (push). The pull model is used in the following description, but it applies equally to the push model.

A transaction may result in a number of distinct events, each of which is logged separately; the messages of events for a particular transaction have the same ELID, and so all the events for a transaction can be associated. It is the responsibility of the billing mediation device 6 (or some other external system) to reconcile the events for a particular transaction into meaningful billing information for the operator.

While the gateway can track (and record events for) individual transactions between the client and the web server, it has no understanding of the content or value of the service being provided to the user of the client. For example, when accessing a banking application, a user probably has to navigate through a series of menus in order to achieve the service. In a scenario where a user wants to transfer money from one account to the other, an interaction with the web server might be as follows.

1. The user enters his username and secret password to get access to the basic menus
2. The user selects Account Transfer (rather than Balance Enquiry, Chequebook Order, Bill Payment, etc.)
3. The user selects the two accounts for the transfer and the amount to be transferred
4. The application asks the user to confirm the transfer, possibly requesting that the password is re-entered. The success of the transfer is indicated to the user.
5. The user would then sign-off from the application.

This simple service could result in as many as five events, but it is the fourth event that provides the real value for the user and the application provider, i.e. the successful transfer of money from one account to the other. If the user entered the wrong username or password, or unknown account numbers, or the bank was not allowing transfers at this moment in time, transactions would still take place between the client and the web server, but no valuable service has been provided to the user. Similarly, moving £1000 from one account to the other might be considered to have more value than a balance enquiry or ordering a chequebook.

The gateway 1 cannot determine (purely from the transaction) whether a useful service has been provided to the user, or how useful/valuable that service was. Therefore, it would not be possible for the operator to take account of the value of the service provided in billing (or indeed not billing) the user. Only the application (resident on the Web server) can determine in all circumstances whether a service has been provided and the degree of value.

The invention provides a major advance for the network operator as it allows it to enhance its billing strategy and differentiate itself from competitors. The application can include any information it wishes in the billing header, for example the success of the service, the value of the service (e.g. £1000 transferred), the names of the books the user purchased, etc. The format of the information just needs to be agreed between the operator and the application.

The billing header is included in one or more of the event messages created for the transaction. The operator can then consider the information in the billing header when determining whether and how much to bill the user for the service. For example, the operator might choose not to bill the user for any of the transactions unless the user was successfully provided with a service; or the user might be billed a small amount for each transaction, and then an additional fee for successful services; and some services might be premium rate, while others might be lower rates. The

operator might enter into an agreement with the application provider where the operator bills the user and provides a portion of the revenue to the application provider. Conversely, the application provider may receive the revenue from the user, for example credit card transaction or account transfer, and have to provide a portion to the operator. In this case, the billing header could allow the operator to track the amount due from the application provider.

Event messages are created in a binary 'Tag, Length, Value' (TLV) format. Each message has a numeric identifier, called the Event ID. The table below illustrates some example messages. Also shown is an example list of parameters, which might be included in the message. Every message is separately configurable as to whether or not it is logged to the Billing Manager. A number of parameters are common to every message. They are:

EVENT_ID
DATE_TIME
EVENT_LINKAGE_ID

Event ID	*Description*	*Parameters present*
3003	Confirms that a transaction response has been received by the client.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE MSISDN CLIENT_ID PDU_SIZE
3004	A timeout occurred when waiting for a confirmation of a transaction response from the client.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE
3005	There has been a WMLScript compilation failure.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE
3010	There has been a WML encoding failure.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE
3013	Generated when the network is unavailable (e.g. the requested site does not exist or a timeout occurred trying to connect to the site)	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE DEST_ADDRESS DEST_PORT MSISDN

		CLIENT_ID
3014	An HTTP response has been received from the origin server.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE STATUS URI CONTENT_LENGTH MSISDN CLIENT_ID BILL_HTTP_HEADER** BILL_HTTP_VALUE**
3017	An HTTP request has been received from the handset.	SOURCE_ADDRESS SOURCE_PORT BEARER_TYPE URI MSISDN CLIENT_ID CLASS_OF_INTERFACE USER_AGENT_HEADER CLASS_OF_SERVICE

As is clear from the above only the message for event 3014 has a billing header. Many event messages do not include headers because:

- Only the application knows whether a useful service has been provided to the user, and so the application decides the transactions for which to return a billing header. Therefore, the billing header may not have been returned for some transactions and therefore cannot be included in the events resulting from that transaction.
- Some events are recognised by the gateway before the web server has returned the response to the request. For example an event might be that a request had been received from the client, or that the request has been forwarded to the Web server. Since no response has yet been received from the Web server, no billing header exists and therefore cannot be included in any events.
- The gateway may produce a number of event messages once the response is returned from the Web server. If the billing header was included in the response, it does not need to be included in every event message because:

The first byte has the most significant bit set, so a second byte is read. The second byte doesn't have the most significant bit set so no more bytes are read. Excluding the most significant bits, the two sets of 7 bits make up a 14 bit number:

0	0	0	0	0	0	1	0	0	0	1	1	0	1

The value of this number is 141 in decimal.

- The format of the *value* itself depends on the type of the tag. Below are some example tags. Each event will use the appropriate set of tags required to represent its parameters.

Tag	Name	Type	Notes
0x0006	STATUS	Integer value	The HTTP status code.
0x0007	SOURCE_ADDRESS	Dotted quad or ASCII text	The address is encoded depending on the Bearer type. If the Bearer is ANY_ANY_IPV4, then the address is an integer value suitable for an Internet address. If the Bearer is GSM_SMS_GSM_MSISDN, then the address is SMS encoded as ASCII text.
0x0008	SOURCE_PORT	Integer value	Port number which matches the Source address.
0x0009	BEARER_TYPE	Integer value	Values as defined by WAP. ANY_ANY_IPV4 = 0, GSM_SMS_GSM_MSISDN = 3.
0x000A	DEST_ADDRESS	Dotted quad or ASCII text	Encoded in the same way as the Source address.
0x000B	DEST_PORT	Integer value	Port number which matches the Destination address.
0x001A	URI	ASCII text	The URI which has been accessed.
0x0024	EVENT_LINKAGE_ID	Integer value	This is the identifier used to link all events related to a particular transaction together. It is a 32-bit number.
0x002B	EVENT_ID	Integer value	This number identifies the event itself, as defined in the table in Chapter 6.
0x002E	DATE_TIME	Integer value	Epoch time when the event was generated.
0x0032	CONTENT_LENGTH	Integer value	The length of the retrieved content.
0x0048	MSISDN	ASCII text	Represents an MSISDN number.
0x004A	BILL_HTTP_HEADER	ASCII text	The name of the in-band billing header (always "x-up-billing-info").
0x004B	BILL_HTTP_VALUE	ASCII text	The corresponding value for the in-band billing header.
0x0056	PDU_SIZE	Integer value	Size in bytes of the WSP PDU transmitted over the bearer.

- All events can be associated via the ELID and therefore the billing header only needs to be included in at least one event
- On a system with high traffic levels, the processing and storage of unnecessary or redundant data needs to be avoided. For example, it could cause increased use of disk storage space, performance degradation, or unnecessary use of bandwidth on the real-time connection, all of which represent some form of cost for the operator.

All parameters are represented in a binary TLV format. Each parameter is composed of three parts: A numeric tag which identifies the parameter name; a length which represents the length of the value in bytes; and the value itself. These three parts are defined as:

- The numeric *tag* is always represented with two bytes. See below for a table below defining some example tags.
- The *length* is represented with one or more bytes, with the most significant bit in each byte being used to indicate if the next byte is also part of the length. This is known as Extension-Bit format. After reading the first byte, if the most significant bit is set then the next byte is also read. This continues until a byte read does not have the most significant bit set, up to a maximum of 5 bytes. The numbers represented by the least 7 significant bits of each byte are then used to give the total length. An example is:

The number 0x810D would be decoded as:

BYTE 1								BYTE 2							
1	0	0	0	0	0	0	1	*0*	0	0	0	1	1	0	1

It will be appreciated that the invention allows for control of billing data in a simple, reliable, and versatile manner. For example, this allows choice of which party obtains the "value-added" benefit for transactions or other application operations. It also allows pre-paid billing functionality by providing data for a subscriber account on a pre-paid billing platform. This may, for example, be used to determine if requested content should be returned to the subscriber. The returned data could also be used to influence other decision-making procedures in the gateway. Because the log entry is made after the client acknowledgement, the user will not be billed if there is a transmission error or if the user cancels.

The invention is not limited to the embodiments described but may be varied in construction and detail. For example, while the event messages are received and processed by a WAP gateway, they may alternatively be processed by any routing node between the application and the user device. The term "gateway" is intended to mean any such node or device.

Claims

1. A method of capturing billing data for operation of an application on a network server communicating with a client via a gateway, the method comprising the steps of:-

the application automatically generating billing data relating to a service it provides;

the application automatically transmitting the billing data to the gateway; and

the gateway processing the billing data.

2. A method as claimed in claim 1, wherein the application transmits the billing data in an event message according to a pre-set format.

3. A method as claimed in claim 2, wherein the message comprises a HTTP header.

4. A method as claimed in any preceding claim, wherein the application generates a message for each activity recognised as an event and transmits said messages to the gateway.

5. A method as claimed in claim 4, wherein the application recognises a plurality of events for a transaction.

6. A method as claimed in claim 5, wherein the application includes a common event linkage identifier in each event message associated with a particular transaction.

7. A method as claimed in any of claims 2 to 6, wherein the application recognises a transaction failure as an event.

8. A method as claimed in any of claims 2 to 7, wherein the application recognises a time-out as an event.

9. A method as claimed in any of claims 2 to 8, wherein each event message has a unique identifier.

10. A method as claimed in claim 9, wherein the identifier is a number whereby identifiers of sequential messages are sequential numbers.

11. A method as claimed in any of claims 2 to 10, wherein each event message comprises at least one parameter value.

12. A method as claimed in claim 11, wherein each parameter value is represented in a tag-length-value format in which a tag field identifies a parameter name, the length field identifies the length of the value in bytes, and the value field contains the parameter value.

13. A method as claimed in any preceding claim, wherein the gateway generates billing data according to signal flows between the application and the client, and stores said billing data in addition to that originating from the application.

14. A method as claimed in any of claims 2 to 13, wherein the gateway recognises events according to signal flows between the application and the client, and generates corresponding messages.

15. A method as claimed in any of claims 2 to 14, wherein the gateway routes event messages to a billing log for off-line processing or to a real time mediation device for real time processing according to configuration settings.

16. A method as claimed in claim 15, wherein the gateway routes event messages to the real time mediation device if the events relate to pre-paid services.

17. A method as claimed in any preceding claim, wherein, within the gateway, messages are routed in real time to a billing manager, and said billing manager processes the messages.

18. A gateway for routing of signals between a client and an application hosted on a network server for performance of a transaction, the gateway comprising:

means for receiving billing data from the application, said billing data relating to a service provided by the application; and

means for processing the billing data.

19. A gateway as claimed in claim 18, wherein the processing means comprises means for classifying the data as requiring real time processing or off-line processing, and for routing the data accordingly.

20. A gateway as claimed in claims 18 or 19, wherein the billing data is incorporated in event messages.

21. A gateway as claimed in claim 20, wherein the gateway comprises means for generating event messages according to handling of signals for transaction.

22. A gateway as claimed in any of claims 18 to 21, wherein the gateway comprises a billing manager, means for routing billing data in real time to the billing manager, and means in the billing manager for directing storage of the data in a log for off-line processing or for routing the data to a real time mediation device for real time processing.

23. A billing system comprising:

a gateway as claimed in claim 22;

a mediation device comprising means for reading billing data in a billing log which is updated by the gateway and for processing said billing data; and

a real time mediation device comprising means for performing real time processing of billing data received from the gateway.

24. A computer program product comprising software code for performing the steps of any of claims 1 to 17 when executed on a digital computer.

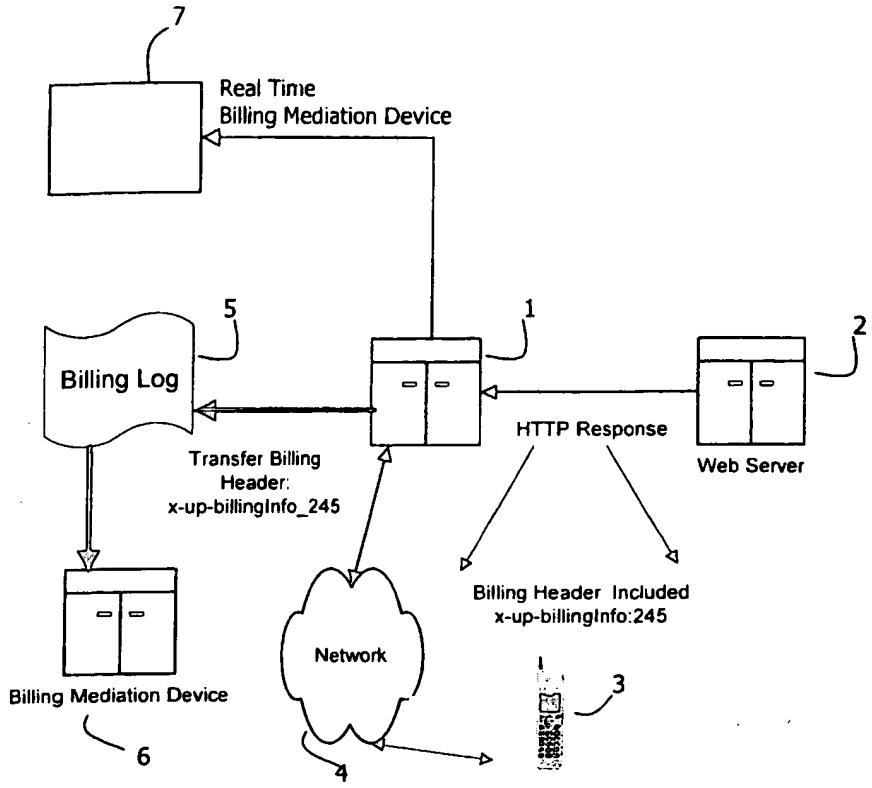
7
Real Time
Billing Mediation Device
5
Billing Log
1
2
HTTP Response
Web Server
Transfer Billing
Header:
x-up-billingInfo_245
Billing Header Included
x-up-billingInfo:245
Network
3
Billing Mediation Device
6
4

Fig. 1